Section 4 Managing Demand to Accommodate Future Traffic with Existing Runways

One approach to accommodating the growing demand at Bay Area airports is to consider modifications of air traffic patterns and volumes. For purposes of this analysis, two alternatives to this strategy are described which are focussed primarily on SFO, the region's most heavily used facility:

- *Demand Management for SFO Traffic* – In this approach, the three-airport system is viewed as a whole and steps are taken to reduce air traffic volumes and redistribute flights between SFO and OAK, thus creating an operating scenario that yields lower delays.
- *New Technology* – In this approach, the introduction of new technology for air traffic control is considered at SFO, and is assumed to increase capacity. This is achieved by reducing in-trail separation minimums and/or by lowering weather restrictions on the use of closely spaced parallel runways.

This section examines how these strategies would affect existing and future aircraft delays for San Francisco, Oakland and San Jose airports, without changing airfield configurations.

In general, introduction of new technology translates into an increase in effective airfield capacity. Benefits from new air traffic technology would apply to existing airfields as well as to airfields with new runways. A scenario combining new technology and new runway configurations is addressed in Section 6.

4.1 PRACTICAL LIMITS OF DEMAND MANAGEMENT

Before presenting the demand management strategies, it should be noted that, while employing these strategies may theoretically reduce delays, there are a number of factors that limit the feasibility of imposing such schedule modifications. These factors include market-based, legal and operational issues.

- From a market-based perspective, increasing flight frequencies is a response to increased demand and artificial limitations that inhibit supply will increase customer inconvenience.
- From a legal perspective, it is illegal under federal airline deregulation laws for airports to artificially limit competition or "move" flights from one airport to another. Attempts at imposing schedule changes may be met by legal challenges from the airlines.
- From an operational perspective, the composition of an airline's fleet may be critical to its operations (such as frequent short-haul flights). For this reason, it is expected that forced alteration of an airline's operations and fleet mix that create scheduling and economic inefficiencies would be challenged.

There may also be other related impacts of regulating aircraft size, such as terminal gate requirements, increased airline operating costs, and effects on airline labor agreements.

4.2 1999 SENSITIVITY ANALYSIS

As a precursor to modeling modified future aircraft schedules and operations, a sensitivity analysis was performed using 1999 schedules and facilities. This sensitivity analysis explores the impact of demand management strategies and shows the potential magnitude of delay reductions resulting from such modifications.

A base case for comparison was established and two cases for analysis developed. These are described below.

- *Base Case* – Actual flight schedule for average day of the peak month (August mid-week) for the Bay Area. Runway configurations for the three airports are the existing layouts. This analysis is presented in Section 3.
- *Sensitivity Case S1* – Uses the existing runway configurations for the three airports. Flight schedules are modified: SFO corporate and general aviation operations are moved to Oakland, and SFO commuter turboprop flights are replaced by half the number of larger regional jets. This does not change the total number of seats offered.
- *Sensitivity Case S2* – Uses the existing runway configurations for the three airports. Flight schedules are modified: SFO corporate and general aviation operations are moved to Oakland, and SFO commuter turboprop flights are replaced by regional jets (as in S1). In addition, flights between SFO and a number of Southern California airports – BUR, LAX, ONT, SBA, SNA, and SAN – are decreased by 26% to reflect larger aircraft (total seats offered are kept constant).

4.2.1 Comparison of Operations

A comparison of the modified traffic volumes for each of the three Bay Area airports under the conditions of the sensitivity cases yielded the following results:

- For San Francisco, the number of operations was reduced from the Base Case total of 1,241 to 1,085 in S1 and 1,028 in S2 (Figure 4-1).
- In Oakland, the absorption of flights from San Francisco resulted in an increase from 548 operations in the Base Case to 614 operations in both S1 and S2 on the South Field (Figure 4-2).
- Operations at San Jose remained unchanged with a total of 473 in all three cases of the sensitivity analysis (Figure 4-3).

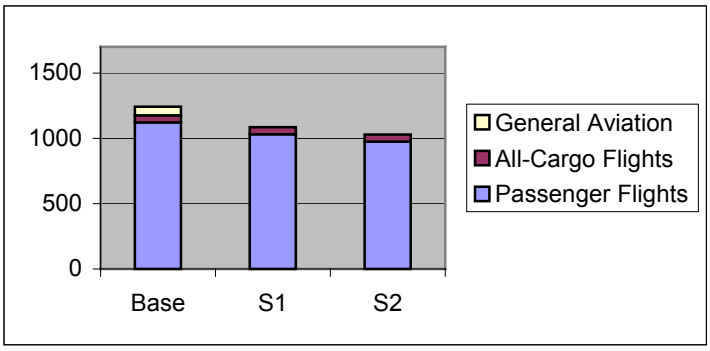

Figure 4-1 Comparison of 1999 SFO Operations

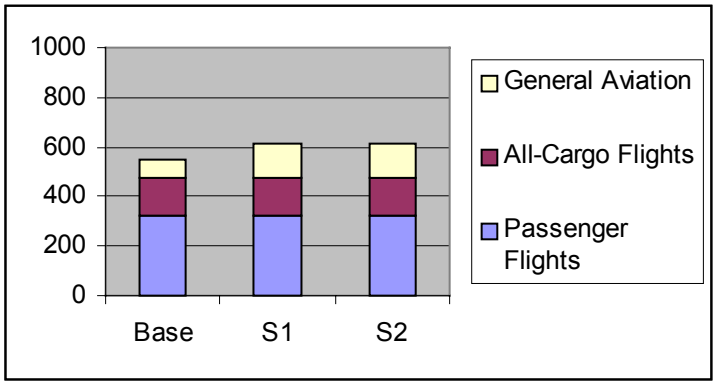

Figure 4-2 Comparison of 1999 Oakland Operations

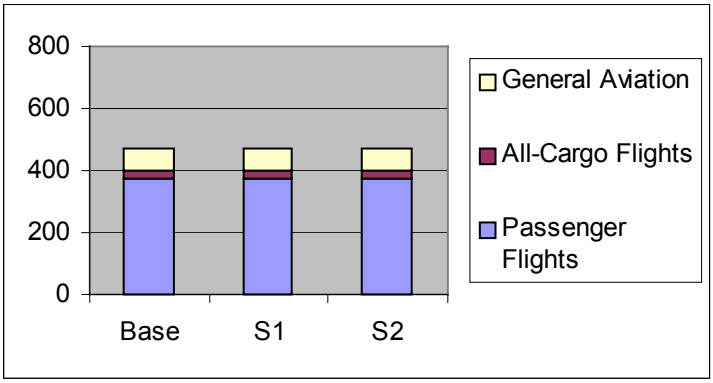

Figure 4-3 Comparison of 1999 San Jose Operations

4.2.2 Delay

Analysis of 1999 delay in the Base Case was discussed in detail in Section 3.4, and 1999 delays are summarized in Tables 3-1, 3-2, and 3-3. As expected when the number of SFO operations is reduced from the Base Case to S1 and then further reduced to S2, delays will be reduced, as discussed below and shown in Tables 4-1 and 4-2.

- *SFO Arrivals* – In general, delays are decreased due to the reduction and diversion of flights from SFO to OAK. Under West VFR operations, delay improved from 2.31 minutes in the Base Case, to 1.94 minutes in both S1 and S2. Under both West IFR and SE IFR operations, delay is reduced by more than 50% from the Base Case, although it is still in the saturated range.
- *SFO Departures* – Delays here are again decreased. Under West VFR operations, delay has improved from 4.74 minutes in the Base Case to 3.63 minutes, well within the acceptable range. For S2, the decrease is from 4.74 minutes to 2.46 minutes, within the free flow range. Under West IFR, delay improved from the congested range in the Base Case (5.78 minutes) to acceptable in S1 (4.08 minutes) and to free-flowing in S2 (2.95 minutes). Under SE IFR operations, delays remain at saturated levels for both S1 and S2.
- *OAK Arrivals* – Because Oakland absorbs some flights from San Francisco, its delays increase in general, but in most cases remain in much the same range. Under West VFR, IFR, and SE IFR operations, delay increases from the Base Case, but still remains in the free flow range in both S1 and S2.
- *OAK Departures* – Similar to arrivals, under West VFR, IFR and SE IFR operations, delay increases from the Base Case, but is still in the free flow and acceptable ranges for S1 and S2.
- *SJC Arrivals* – Delays remain the same in all three scenarios (Base Case, S1 and S2) and for West VFR and IFR. For SE operations, delay increases from the Base Case, but still remains in the free flow range for S1 and S2.
- *SJC Departures* – Under West VFR and IFR operations, delay varies from the Base Case, but still remains in the acceptable range for S1 and S2. Under SE IFR operations, delay decreases and is within the acceptable range.
- *Bay Area Weighted Averages* – When operations at all three airports are considered together and all three weather-related conditions are averaged in proportion to their occurrence, a weighted average for the Bay Area as a whole gives the following delay results:
  - S1 Weighted Averages - Average arrival delays decrease from 17.00 minutes in the Base Case to an average delay of 7.61 minutes per flight. Average departure delays decrease from 3.47 minutes in the Base Case to an average delay of 3.81 minutes per flight, well within the acceptable range.
  - S2 Weighted Averages – Average arrival delays decrease from 17.00 minutes in the Base Case to an average delay of 5.13 minutes per flight, falling near the acceptable range. Average departure delays decrease from 3.47 minutes in the Base Case to 3.25 minutes per flight, well within the acceptable range.

Table 4-1
Sensitivity S1 1999 Delay

Alternatives	1999 Arrival Delays (min)				1999 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	542	1.94	0.01	1.94	543	0.57	0.01	3.05	3.63	1085	2.79
West IFR	542	69.57	0.00	69.57	543	0.04	0.01	4.03	4.08	1085	36.79
SE IFR	542	29.68	0.01	29.70	543	2.66	0.00	25.52	28.18	1085	28.94
Weighted Avg.	542			13.53	543				4.96	1085	9.24
OAK											
West VFR	281	1.28	0.00	1.28	333	1.34	0.00	1.47	2.81	614	2.11
West IFR	281	1.70	0.00	1.70	333	0.10	0.00	0.95	1.05	614	1.35
SE IFR	281	2.55	0.00	2.55	333	3.21	0.00	1.14	4.34	614	3.52
Weighted Avg.	281			1.41	333				2.67	614	2.09
SJC											
West VFR	218	0.88	0.00	0.88	255	1.27	0.63	0.83	2.72	473	1.87
West IFR	218	0.51	0.00	0.51	255	0.49	0.68	0.83	2.00	473	1.31
SE IFR	218	1.50	0.00	1.50	255	3.26	0.00	1.47	4.73	473	3.24
Weighted Avg.	218			0.91	255				2.84	473	1.95
Bay Area											
Weighted Avg.	1041			7.61	1131				3.81	2172	5.63

Table 4-2
Sensitivity S2 1999 Delays

Alternatives	1999 Arrival Delays (min)				1999 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	513	1.93	0.01	1.94	515	0.74	0.01	2.46	3.22	1028	2.58
West IFR	513	46.35	0.00	46.35	515	0.05	0.01	2.88	2.95	1028	24.61
SE IFR	513	8.71	0.02	8.73	515	2.79	0.00	8.97	11.76	1028	10.25
Weighted Avg.	513			8.96	515				3.62	1028	6.29
OAK											
West VFR	281	1.28	0.00	1.28	333	1.37	0.00	1.67	3.04	614	2.23
West IFR	281	1.70	0.00	1.70	333	0.10	0.00	0.97	1.07	614	1.36
SE IFR	281	2.55	0.00	2.55	333	3.34	0.00	1.32	4.66	614	3.69
Weighted Avg.	281			1.41	333				2.87	614	2.20
SJC											
West VFR	218	0.88	0.00	0.88	255	1.44	0.73	0.81	2.98	473	2.01
West IFR	218	0.51	0.00	0.51	255	0.33	0.44	0.77	1.54	473	1.07
SE IFR	218	1.50	0.00	1.50	255	2.99	0.00	1.24	4.24	473	2.98
Weighted Avg.	218			0.91	255				2.99	473	2.03
Bay Area											
Weighted Avg.	1012			5.13	1103				3.25	2115	4.15

4.3 YEAR 2010 AND 2020 FLIGHT SCHEDULES

Design day flight schedules (simulation event files) for 2010 and 2020 for each of the three airports were developed to provide the number of aircraft operations, the time of arrivals and departures, and the types of aircraft. The schedules presented are unconstrained and serve as a basis for comparison to the modified schedules. As with the 1999 schedules, this input data to SIMMOD is developed as a flight schedule over the full 24 hours of airport operations for the average day of the peak traffic month (ADPM), which is a mid-week day in August.

Figures 4-4 through 4-9 show graphically the 2010 and 2020 flight schedules for each of the three airports used in the model simulations.

4.3.1 SFO Flight Schedule

As shown in Figure 4-4, the 2010 ADPM flight schedule includes about 1378 daily arrivals and departures, comprised of commercial passenger, cargo and general aviation flights. The busiest arrival peak occurs from 10PM to 11PM, when 56 flights arrive. The busiest departure peak occurs from 11AM to 12AM when 50 flights depart.

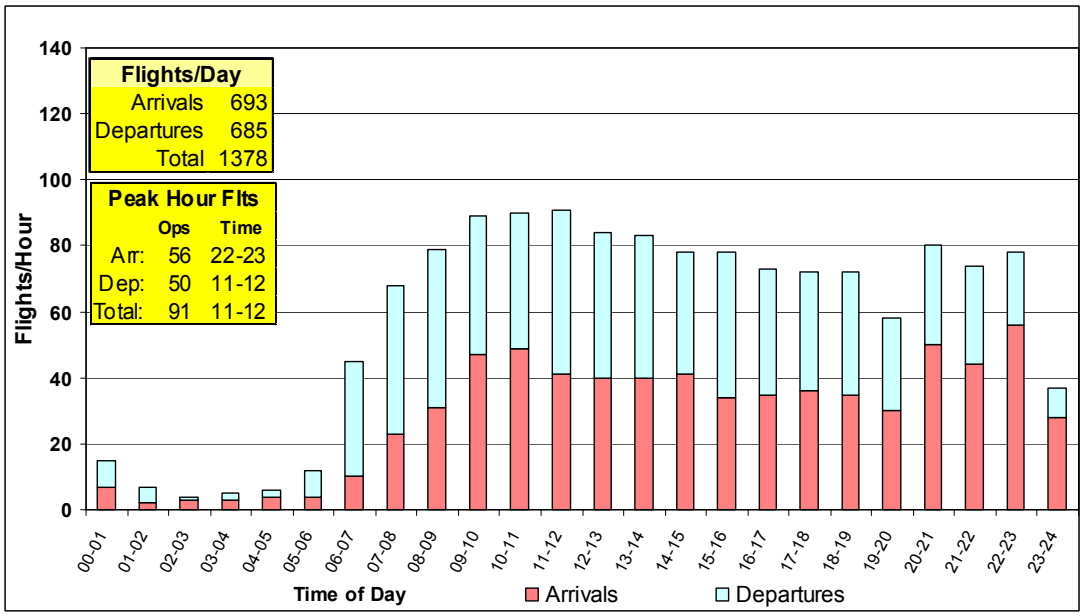

Figure 4-4 2010 Unconstrained Forecast – ADPM SFO Operations

As shown in Figure 4-5, the 2020 ADPM flight schedule includes about 1634 daily arrivals and departures. The busiest arrival peak occurs from 10AM to 11AM, when 62 flights arrive. The busiest departure peak occurs from 11AM to 12AM when 63 flights depart.

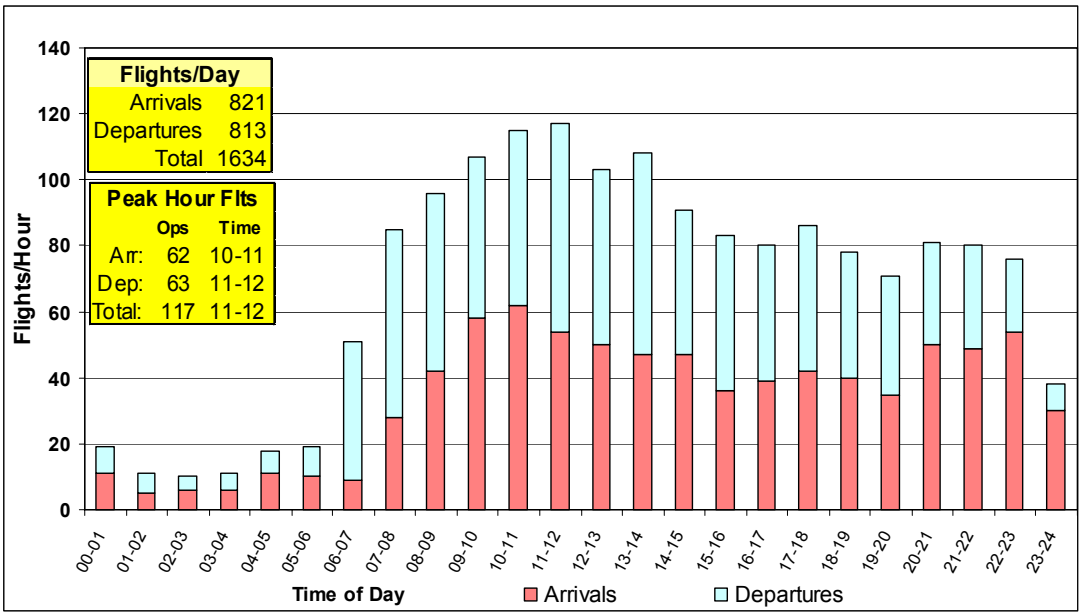

Figure 4-5 2020 Unconstrained Forecast – ADPM SFO Operations

4.3.2 OAK Flight Schedule

The Oakland schedule includes all aircraft arriving and departing the South Field. As shown in Figure 4-6, the 2010 ADPM flight schedule includes about 700 daily arrivals and departures. The busiest arrival peak occurs from 9PM to 10PM, when 30 flights arrive. The busiest departure peak occurs from 7AM to 8AM when 29 flights depart.

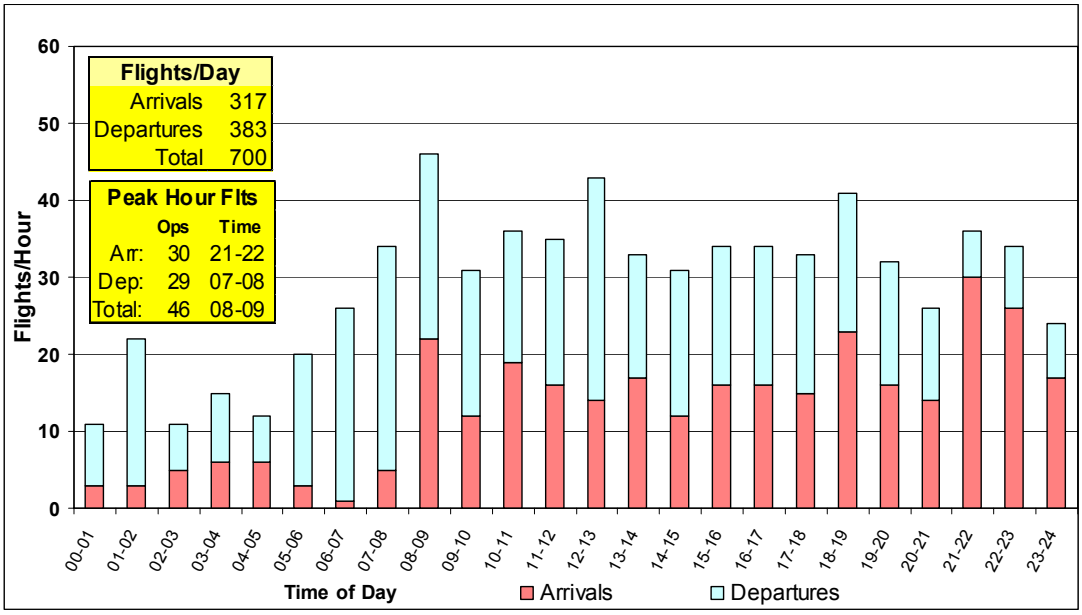

Figure 4-6 – 2010 Unconstrained Forecast – ADPM OAK Operations

As shown in Figure 4-7, the 2020 ADPM flight schedule includes about 893 daily arrivals and departures. The busiest arrival peak occurs from 8AM to 9AM, when 28 flights arrive. The busiest departure peak occurs from 12PM to 1PM when 39 flights depart.

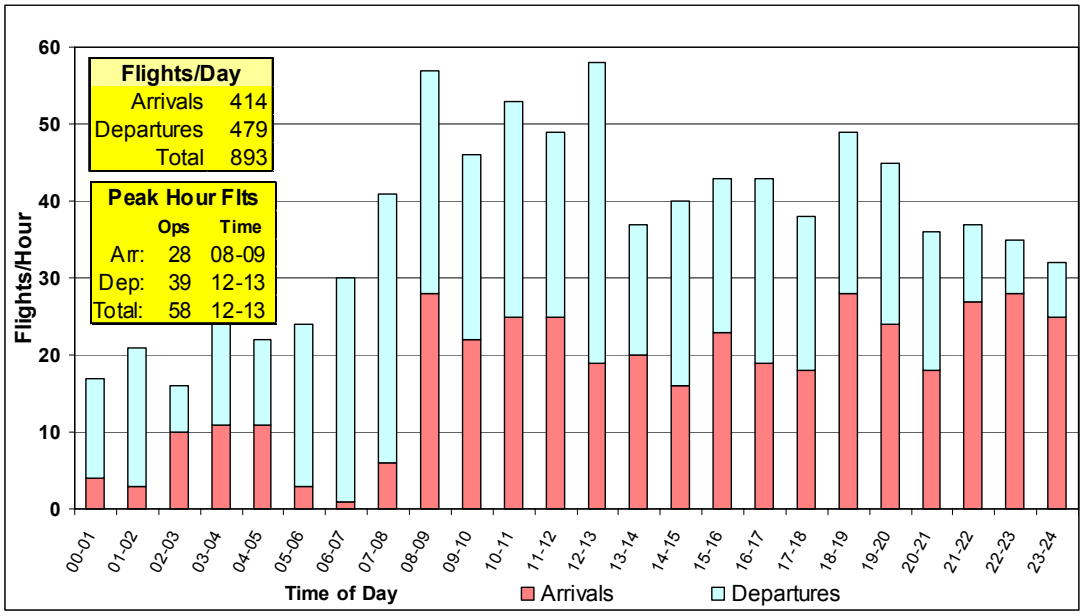

Figure 4-7 2020 Unconstrained Forecast – ADPM OAK Operations

4.3.3 SJC Flight Schedule

The San Jose schedule includes all aircraft using the two air carrier runways (one is currently under construction). As shown in Figure 4-8, the 2010 ADPM flight schedule includes about 539 daily arrivals and departures. The busiest arrival peak occurs from 9PM to 10PM, when 27 flights arrive. The busiest departure peak occurs from 7AM to 8AM when 26 flights depart.

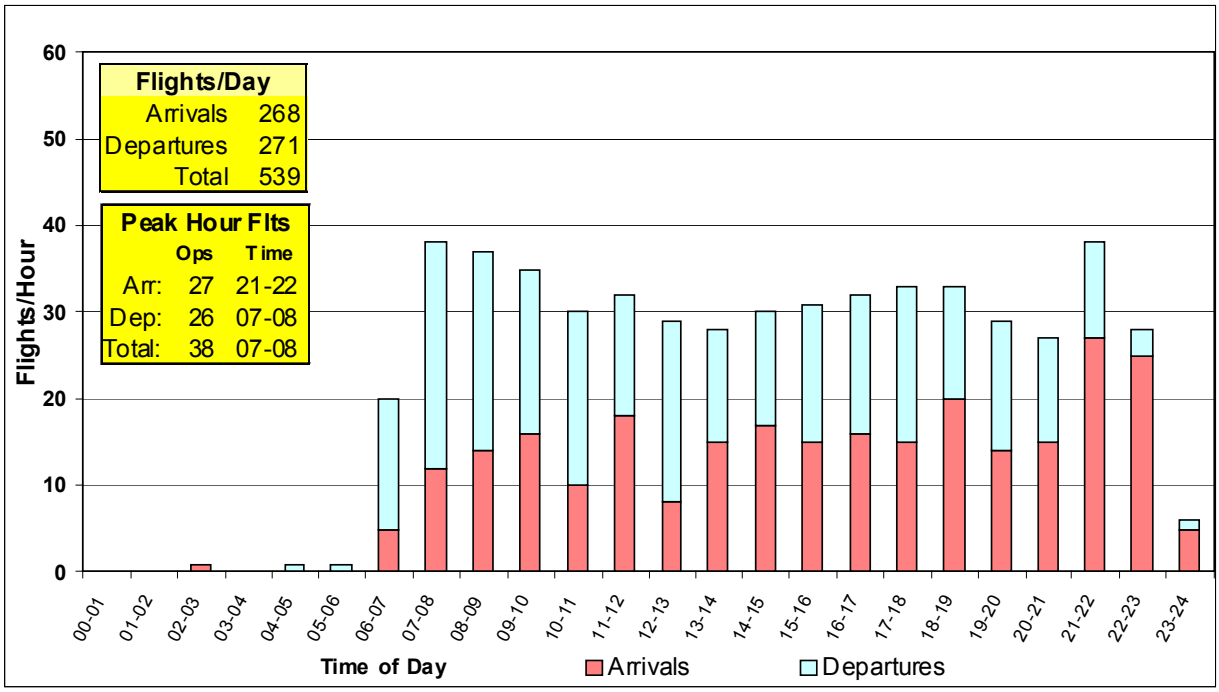

Figure 4-8 2010 Unconstrained Forecast – ADPM SJC Operations

As shown in Figure 4-9, the 2020 ADPM flight schedule includes about 713 daily arrivals and departures. The busiest arrival peak occurs from 9PM to 10PM, when 31 flights arrive. The busiest departure peak occurs from 8AM to 9AM when 34 flights depart.

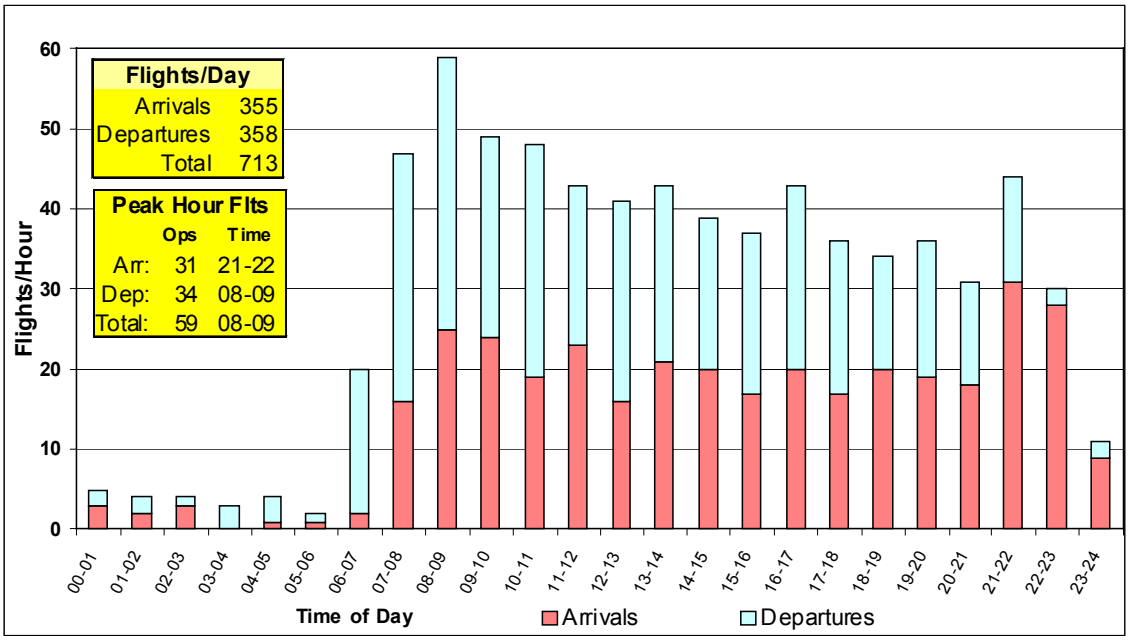

Figure 4-9 2020 Unconstrained Forecast – ADPM SJC Operations

4.4 BASE CASE DELAYS IN 2010 AND 2020

The delays presented in this subsection are for the Base Case for 2010 and 2020 operations. It is assumed that there are no changes to the existing airfield at SFO and at OAK, and that San Jose completes the new runway currently under construction. The flight schedules are assumed to be unconstrained.

At SFO, it is assumed that the simultaneous offset instrument approach/ precision runway monitor (SOIA/PRM) procedures are in use. The effect of this procedure is to allow VFR type operations (two arrival streams) during some of the otherwise IFR type of weather (single stream of arrivals). In practice, this adds 7% to the West VFR plan frequency of occurrence and takes away 7% from the West IFR plan frequency of occurence, thus improving the annual weighted average. The resulting delays given these conditions are shown below.

Table 4-3
Delays for the 2010 Base Case + SOIA/PRM at SFO

Alternatives	2010 Arrival Delays (min)				2010 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	693	4.19	0.01	4.20	685	0.65	0.01	8.07	8.74	1378	6.46
West IFR	693	199.55	0.00	199.55	685	0.03	0.02	4.10	4.15	1378	102.42
SE	693	144.13	0.02	144.15	685	1.43	0.00	52.10	53.54	1378	99.11
Weighted Avg.	693			22.95	685				11.02	1378	17.02
OAK											
West VFR	317	1.13	0.00	1.13	383	1.38	0.00	2.37	3.74	700	2.56
West IFR	317	2.45	0.00	2.45	383	0.07	0.00	1.06	1.13	700	1.73
SE	317	5.11	0.00	5.11	383	2.94	0.00	1.53	4.48	700	4.77
Weighted Avg.	317			1.53	383				3.44	700	2.57
SJC											
West VFR	268	1.24	0.00	1.24	271	0.09	0.76	0.92	1.76	539	1.50
West IFR	268	0.96	0.00	0.96	271	0.02	1.14	0.91	2.08	539	1.52
SE	268	1.78	0.00	1.78	271	0.51	0.00	2.58	3.09	539	2.44
Weighted Avg.	268			1.27	271				1.89	539	1.58
Bay Area											
Weighted Avg.	1278			13.09	1339				7.00	2617	9.97

Table 4-4
Delays for the 2020 Base Case + SOIA/PRM at SFO

Alternatives	2020 Arrival Delays (min)				2020 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	821	15.72	0.01	15.73	813	0.81	0.03	97.36	98.20	1634	56.76
West IFR	821	314.55	0.00	314.55	813	0.03	0.02	11.02	11.07	1634	163.55
SE IFR	821	254.90	0.00	251.92	813	1.05	0.00	111.13	112.1	1634	182.39
Weighted Avg.	821			45.66	813				94.15	1634	69.79
OAK											
West VFR	414	1.45	0.00	1.45	479	1.44	0.00	11.83	13.27	893	7.79
West IFR	414	3.78	0.00	3.78	479	0.08	0.00	1.99	2.07	893	2.86
SE IFR	414	27.91	0.00	27.91	479	2.48	0.00	4.01	6.49	893	16.42
Weighted Avg.	414			3.26	479				11.42	893	7.64
SJC											
West VFR	355	2.02	0.26	2.28	358	0.09	3.68	1.13	5.17	713	3.73
West IFR	355	9.19	0.15	9.34	358	0.03	2.81	1.12	4.11	713	6.71
SE IFR	355	3.39	0.00	3.39	358	0.40	0.00	8.95	9.34	713	6.38
Weighted Avg.	355			2.79	358				5.44	713	4.12
Bay Area											
Weighted Avg.	1590			25.05	1650				50.89	3240	38.21

4.5 DEMAND MANAGEMENT CASES

Two sensitivity cases involving demand management strategies were developed for simulation. A description outlining the major characteristics of each is presented below. In both these cases, SOIA procedures are also in use.

4.5.1 Description of Cases

A Base Case for comparison to demand management strategies is defined and discussed above in Section 4.3. Two levels of demand management were developed for analysis and are applied to both years 2010 and 2020. These are defined below.

Sensitivity Case S2 Demand Management includes the following characteristics, which are the same as the 1999 S2 case:

- The event file is the 2010 and 2020 average day peak month (August mid-week) for the Bay Area.

- Runway configurations for the three airport system are: San Francisco with no new runways, Oakland with no new runway, and San Jose with a new parallel runway (currently under construction).
- The SFO corporate and general aviation operations are moved to Oakland.
- All SFO commuter turboprop flights are replaced with regional jets of twice the capacity, reducing their frequency by half.
- Southern California flights between SFO and BUR, LAX, ONT, SBA, SNA, and SAN are decreased by 26% to reflect the future use of larger aircraft.

Sensitivity Case S3 Demand Management:

- The event file is the 2010 and 2020 average day peak month (August mid-week) for the Bay Area.
- Runway configurations for the three airport system are: San Francisco with no new runways, Oakland with no new runway, and San Jose with a new parallel runway (under construction). (Note that the amount of traffic shifted to OAK could exceed the capacity of its single runway as measured by average delay.)
- The SFO corporate and general aviation operations are moved to Oakland.
- All SFO commuter turboprop operations are replaced with regional jets of twice the capacity reducing their frequency by half and also moved to Oakland.
- Flights between SFO and BUR, LAX, ONT, SBA, SNA, and SAN are held at 1999 levels at SFO and additional flights to these Southern California airports above the 1999 level are moved to Oakland.

A comparison of the volume of operations for the Base Case and two demand management sensitivity cases is discussed in the following subsection. The delays incurred as a result of employing the above demand management strategies are presented in Sections 4.4 and 4.5.

4.5.2 Comparison of Operations

Similar to the shift of operations between the airports under the 1999 sensitivity analysis, a comparison is made at each airport in terms of the resulting number of operations with the demand management strategies. In 2010, the operations changed as follows:

- For San Francisco, the number of operations was decreased from the Base Case total of 1378 to 1202 in S2 and 1078 in S3 (Figure 4-10).
- In Oakland, the absorption of flights from San Francisco resulted in an increase from 700 operations in the Base Case to 774 operations in S2 and 926 in S3 (Figure 4-11).
- Operations at San Jose remained unchanged – a total of 539 – in all three cases of the sensitivity analysis (Figure 4-12).

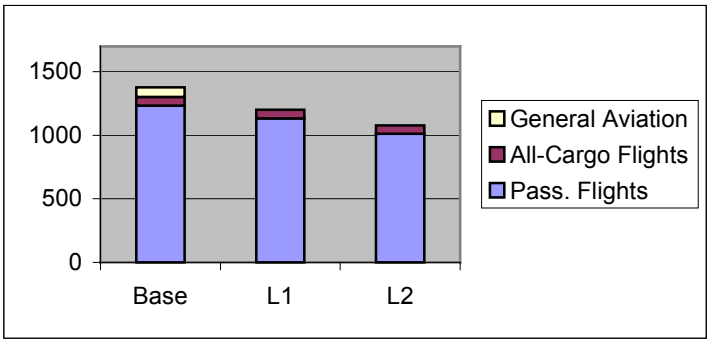

Figure 4-10 Comparison of 2010 SFO Operations

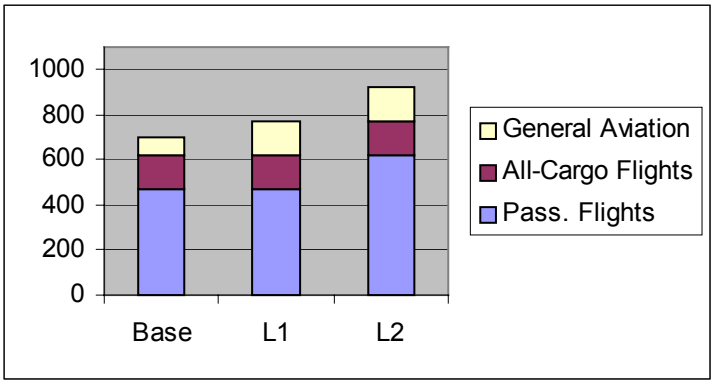

Figure 4-11 Comparison of 2010 OAK Operations

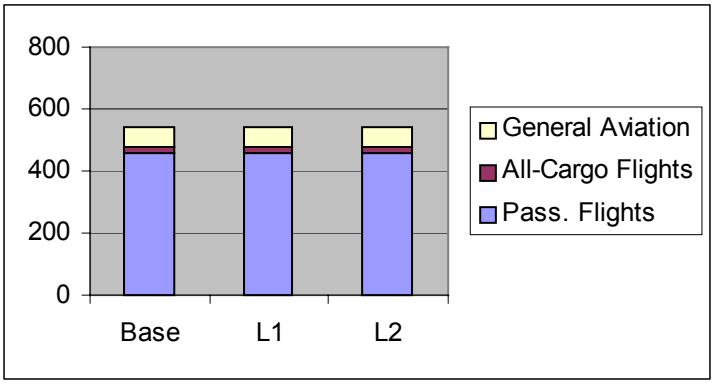

Figure 4-12 Comparison of 2010 SJC Operations

In 2020, the operations changed as follows:

- For San Francisco, the number of operations decreased from the Base Case total of 1634 to 1503 in S2 and 1426 in S3 (Figure 4-13).

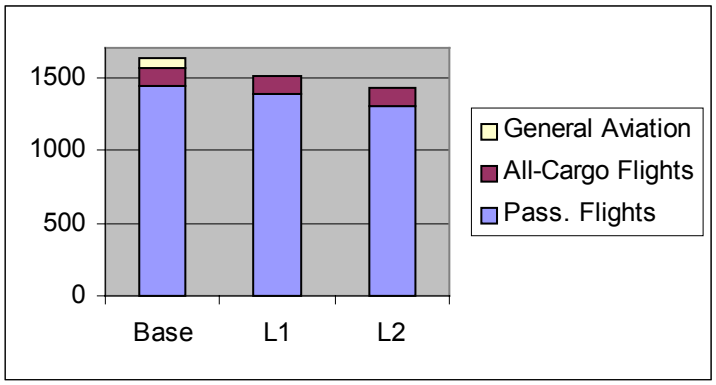

Figure 4-13 Comparison of 2020 SFO Operations

- In Oakland, the absorption of flights from San Francisco resulted in an increase from 893 operations in the Base Case to 969 operations in S2 and 1074 in S3 (Figure 4-14).

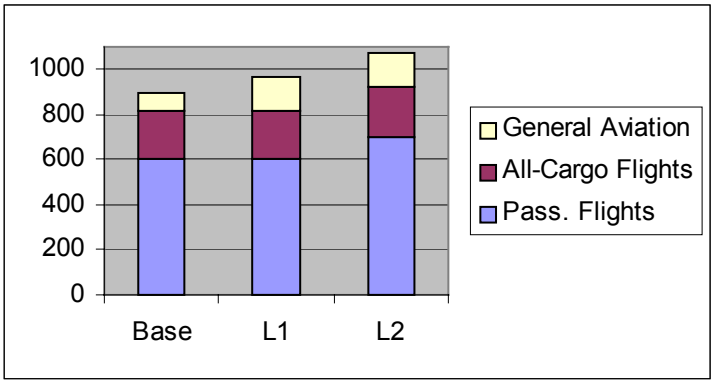

Figure 4-14 Comparison of 2020 OAK Operations

- Operations at San Jose remained unchanged – a total of 713 - in all three cases of the sensitivity analysis (Figure 4-15).

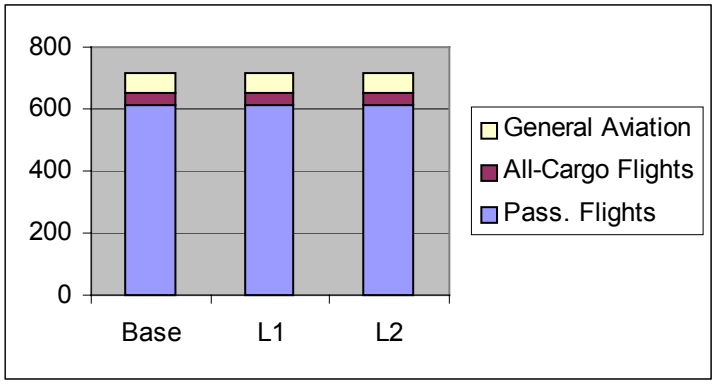

Figure 4-15 Comparison of 2020 SJC Operations

Table 4-5 Resulting Delays for 2010 S2 Demand Reduction + SOIA/PRM at SFO

Alternatives	2010 Arrival Delays (min)				2010 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	601	3.48	0.01	3.49	601	0.54	0.02	7.26	7.83	1202	5.66
West IFR	601	118.86	0.00	118.86	601	0.03	0.01	3.47	3.52	1202	61.19
SE IFR	601	76.22	0.02	76.25	601	1.34	0.00	60.05	61.39	1202	68.82
Weighted Avg.	601			14.00	601				10.62	1202	12.31
OAK											
West VFR	359	1.19	0.00	1.19	415	1.47	0.00	3.06	4.53	774	2.98
West IFR	359	2.88	0.00	2.88	415	0.10	0.00	1.62	1.72	774	2.26
SE IFR	359	2.79	0.00	2.79	415	2.66	0.00	2.16	4.83	774	3.88
Weighted Avg.	359			1.50	415				4.18	774	2.94
SJC											
West VFR	268	1.52	0.00	1.25	271	0.11	0.49	0.88	1.48	539	1.37
West IFR	268	0.97	0.00	0.97	271	0.02	1.00	0.85	1.88	539	1.43
SE IFR	268	1.79	0.00	1.79	271	0.59	0.00	1.89	2.49	539	2.14
Weighted Avg.	268			1.28	271				1.58	539	1.43
Bay Area											
Weighted Avg.	1228			7.57	1287				6.64	2515	7.09

Table 4-6 Resulting Delays for 2010 S3 Demand Reduction + SOIA/PRM at SFO

Alternatives	2010 Arrival Delays (min)				2010 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	539	2.84	0.01	2.85	539	0.68	0.02	2.99	3.69	1078	3.27
West IFR	539	71.18	0.00	71.19	539	0.03	0.02	2.24	2.29	1078	36.74
SE IFR	539	33.08	0.01	33.09	539	1.82	0.00	37.60	39.42	1078	36.26
Weighted Avg.	539			8.35	539				5.63	1078	6.99
OAK											
West VFR	433	1.27	0.00	1.27	491	1.12	0.01	11.49	12.63	924	7.31
West IFR	434	7.07	0.00	7.07	492	0.08	0.00	2.92	3.00	926	4.91
SE IFR	434	4.86	0.00	4.86	492	2.35	0.13	6.43	8.91	926	7.01
Weighted Avg.	434			2.23	492				11.16	925	6.98
SJC											
West VFR	268	1.24	0.00	1.24	271	0.14	0.64	0.83	1.61	539	1.43
West IFR	268	0.97	0.00	0.97	271	0.02	1.23	0.88	2.14	539	1.56
SE IFR	268	1.80	0.00	1.80	271	0.93	0.00	2.02	2.94	539	2.37
Weighted Avg.	268			1.27	271				1.75	539	1.51
Bay Area											
Weighted Avg.	1241			4.68	1302				6.91	2542	5.82

Table 4-7 Resulting Delays for 2020 S2 Demand Reduction + SOIA/PRM at SFO

Alternatives	2020 Arrival Delays (min)				2020 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	751	11.69	0.01	11.70	752	0.66	0.03	44.75	45.43	1503	28.58
West IFR	751	253.94	0.00	253.94	752	0.04	0.01	6.50	6.55	1503	130.16
SE IFR	751	197.34	0.02	197.36	752	1.23	0.00	105.40	106.6	1503	151.96
Weighted Avg.	751			35.64	752				46.73	1503	41.19
OAK											
West VFR	456	1.48	0.00	1.48	513	1.27	0.00	35.68	36.95	969	20.26
West IFR	456	4.60	0.00	4.60	513	0.09	0.00	2.92	3.01	969	3.76
SE IFR	456	5.94	0.00	5.94	513	2.38	0.00	14.45	16.83	969	11.71
Weighted Avg.	456			2.14	513				31.37	969	17.61
SJC											
West VFR	355	2.04	0.00	2.04	358	0.10	1.90	1.13	3.13	713	2.59
West IFR	355	1.63	0.40	2.04	358	0.04	4.57	1.14	6.16	713	4.11
SE IFR	355	3.31	0.00	3.31	358	0.73	0.00	7.63	8.35	713	5.84
Weighted Avg.	355			2.14	358				3.73	713	2.94
Bay Area											
Weighted Avg.	1562			18.25	1623				32.39	3185	25.45

Table 4-8 Resulting Delays for 2020 S3 Demand Reduction + SOIA/PRM at SFO

Alternatives	2020 Arrival Delays (min)				2020 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	713	9.05	0.01	9.06	713	0.74	0.02	44.06	44.82	1426	26.94
West IFR	713	217.29	0.00	217.29	713	0.02	0.01	6.94	6.97	1426	112.13
SE IFR	713	162.42	0.02	162.44	713	1.28	0.00	93.10	94.38	1426	128.41
Weighted Avg.	713			29.28	713				45.52	1426	37.40
OAK											
West VFR	508	1.66	0.00	1.66	566	0.90	0.00	114.77	115.6	1074	61.74
West IFR	508	8.97	0.00	8.97	566	0.06	0.55	16.04	16.65	1074	13.02
SE IFR	508	5.45	0.00	5.45	566	2.09	0.00	77.56	79.65	1074	44.55
Weighted Avg.	508			2.83	566				100.6	1074	54.39
SJC											
West VFR	355	2.03	0.00	2.04	358	0.10	1.85	1.13	3.08	713	2.56
West IFR	355	1.63	0.26	1.89	358	0.02	3.82	1.17	5.33	713	3.62
SE IFR	355	3.31	0.00	3.31	358	0.62	0.00	7.53	8.15	713	5.74
Weighted Avg.	355			2.13	358				3.62	713	2.88
Bay Area											
Weighted Avg.	1576			14.64	1637				55.42	3213	35.42

4.6 NEW TECHNOLOGY REDUCED SEPARATION CASE

In the previous strategies, demand (number of flights) is constrained in order to limit the need for facility development. In the technology approach, the unconstrained flight schedules are left intact, but the impact of advanced Air Traffic Control Systems is modeled by reducing in-trail aircraft separation requirements for all airports, resulting in increased runway capacity. These new technologies are:

- Wide Area Augmentation System (WAAS)
- Local Area Augmentation System (LAAS)
- Center TRACON Automation System
- Final Approach Spacing Tool (FAST)
- Automatic Dependent Surveillance (ADS)

Details of the above technology are discussed in a report prepared by the Metropolitan Transportation Commission in August 2000 entitled "Sensitivity Analysis-Factors Affecting Airport Demand and Capacity", Section 6. For model simulation purposes, assumptions have been made to reduce the in-trail separation between aircraft to reflect the effect of improved navigational technology. The results of this analysis for 2010 are presented in Table 4-9 and can be compared to Table 4-3. The case for new technology was not carried out for the 2020 forecast because even with these improvements, the projected 14.75 minute delay at SFO for the 2010 forecast exceeds saturated levels (Figure 2-2).

Table 4-9
Resulting 2010 Delays with Reduced Separation Through New Technology + SOIA/PRM at SFO

Alternatives	2010 Arrival Delays (min)				2010 Departure Delays (min)					Total Delays (min)	
	Ops	Air	Ground	Total	Ops	Air	Ground	Queue	Total	Ops	Total
SFO											
West VFR	693	4.06	0.01	4.07	685	0.14	0.02	6.00	6.16	1378	5.11
West IFR	693	193.95	0.00	193.96	685	0.02	0.01	4.54	4.57	1378	99.81
SE IFR	693	103.22	0.03	103.25	685	1.45	0.00	60.40	61.85	1378	82.67
Weighted Avg.	693			20.21	685				9.22	1378	14.75
OAK											
West VFR	317	0.78	0.00	0.78	383	0.09	0.00	2.37	2.46	700	1.70
West IFR	317	2.38	0.00	2.38	383	0.07	0.00	1.03	1.10	700	1.68
SE IFR	317	2.86	0.00	2.86	383	2.81	0.00	1.78	4.59	700	3.81
Weighted Avg.	317			1.11	383				2.40	700	1.82
SJC											
West VFR	268	1.22	0.00	1.22	271	0.04	1.05	0.99	2.08	539	1.65
West IFR	268	0.92	0.00	0.92	271	0.02	1.01	0.91	1.94	539	1.43
SE IFR	268	1.78	0.00	1.78	271	0.59	0.00	2.61	3.20	539	2.49
Weighted Avg.	268			1.25	271				2.16	539	1.71
Bay Area											
Weighted Avg.	1278			11.50	1339				5.84	2617	8.60